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DETERMINATION OF BASELINE ATMOSPHERIC PLUTONIUM-239,240 IN THE VICINITY OF THE WASTE ISOLATION PILOT PLANT

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Abstract

Measurements of aerosol $^{239,240}\text{Pu}$ radioactivity have been made in the vicinity of the Waste Isolation Pilot Plant (WIPP) since the fall of 1993. Initially, pilot studies were conducted to (1) evaluate equipment performance and sampling techniques and (2) develop analytical methods. Currently the program is designed to determine, both spatially and temporally, baseline size-specific aerosol mass and radionuclide activity concentration distributions near the WIPP. The purpose of this paper is to describe the radiochemical method developed to determine aerosol $^{239,240}\text{Pu}$ collected on 20 x 25-cm glass fiber filters and present the results of the baseline characterization studies.

The radioanalytical method developed uses total dissolution of the filters, ion exchange chromatography and electrodeposition. The minimum detectable amount, as determined using the ANSI 13.30 criteria, is 200 μBq (5 fCi) assuming a 70% chemical recovery and 3,000 minutes of counting.

Samples for total suspended particulate matter (TSP), those aerosols with an aerodynamic equivalent diameter of less than approximately 75 μm , and particulate matter less than or equal to 10 μm aerodynamic equivalent diameter (PM10) have been routinely collected at a site approximately 1 km from the exhaust shaft of the WIPP. Samples for both TSP and PM10 were collected at 5 m above ground level. Concurrent PM10 samples also were collected at 2 m above ground level. The $^{239,240}\text{Pu}$ activity and aerosol particulate concentrations are presented in Figures 1 and 2, respectively.

Generally, samples were collected continuously over 14 day periods at approximately 1,300 liter min^{-1} and represent a total air volume of approximately 26,000 m^3 . Radioactivity concentration of $^{239,240}\text{Pu}$ at 5 m ranges from 24 - 41 nBq m^{-3} (mean = 32 nBq m^{-3}) for TSP and 12 - 22 nBq m^{-3} for PM10 (mean = 14 nBq m^{-3}). The range of activity concentration of PM10 $^{239,240}\text{Pu}$ at 2 m is 15 - 32 nBq m^{-3} .

(mean = 21 nBq m⁻³). Approximately 50% of ^{239,240}Pu activity is in the PM10 fraction. Comparisons of the PM10 data from 2 m and 5 m indicate that 40% more ^{239,240}Pu activity is found at the 2 m elevation.

Radiochemistry and alpha spectrometry were conducted at the Argonne National Laboratory.

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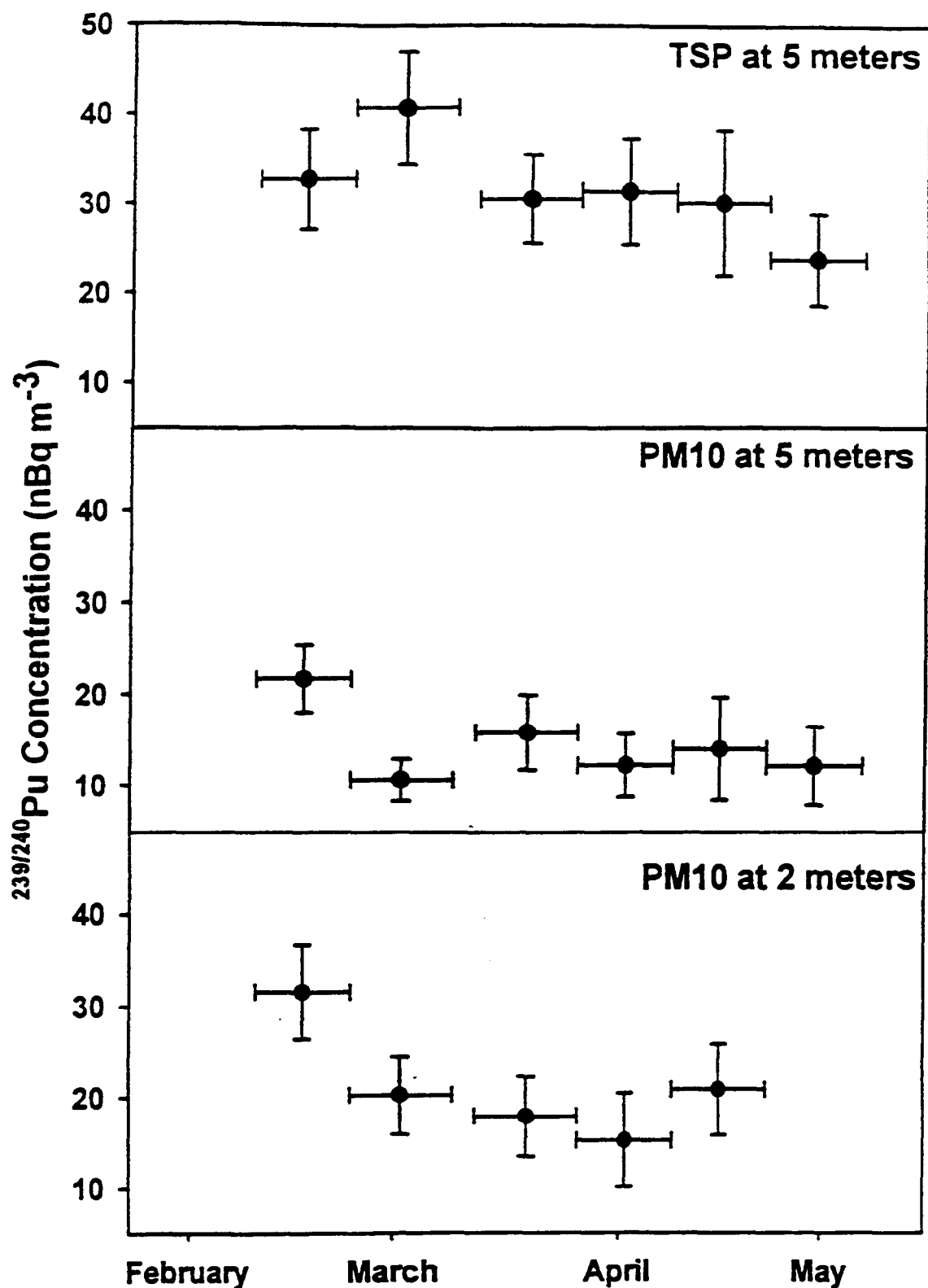


Fig. 1 The $^{239,240}\text{Pu}$ activity concentrations with 95% confidence level of TSP and PM10 at 5 m and 2 m during February - May, 1996. The plotted point indicates the mid-point of the sampling interval.

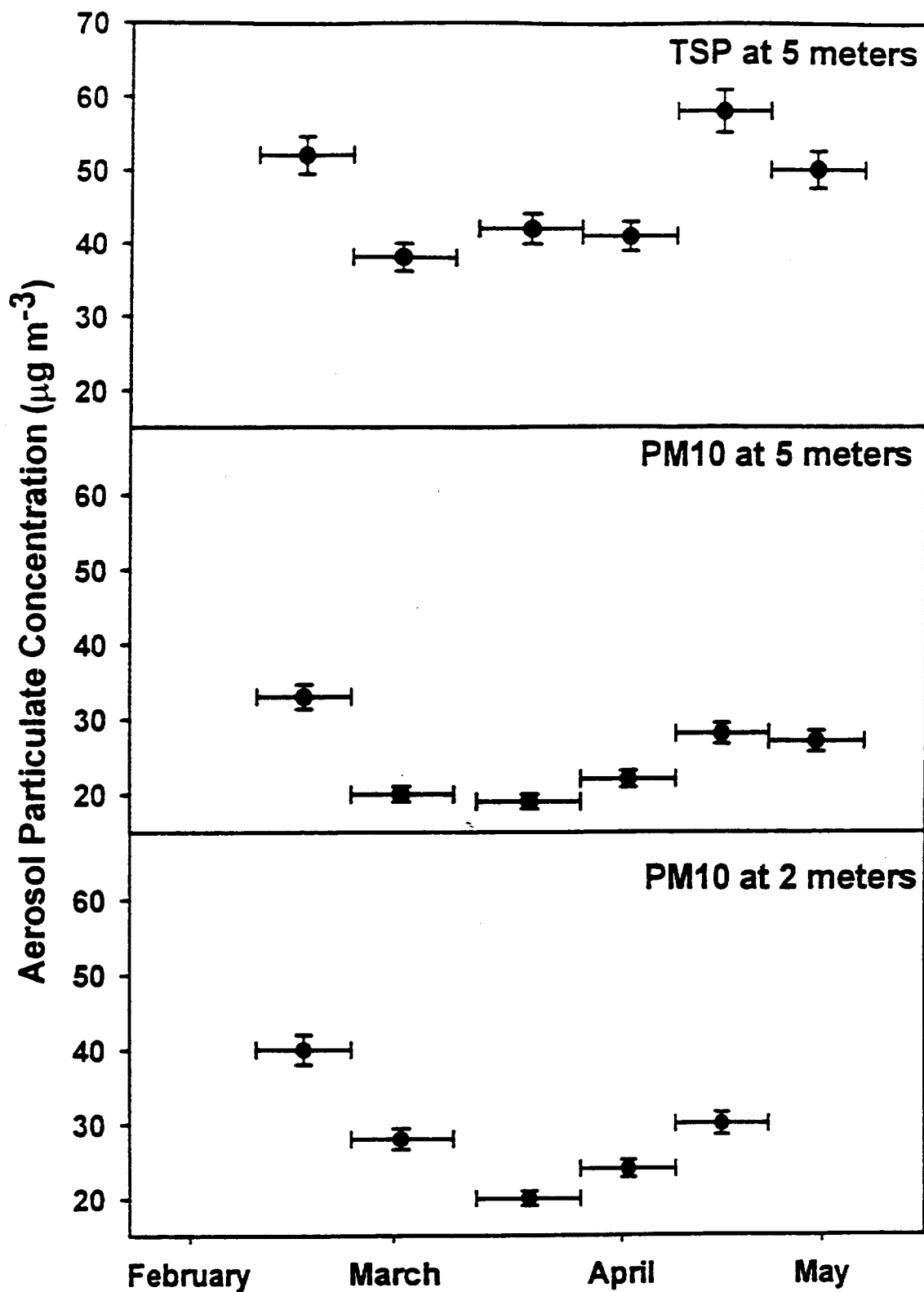


Fig. 2 The aerosol particulate concentrations with 1-sigma uncertainty of TSP and PM10 at 5 m and 2 m during February - May, 1996. The plotted point indicates the mid-point of the sampling interval.